IN THE CLAIMS:

Please amend claims 4-7, 16, 17, and 22, as shown in the complete list of claims that is presented below.

Claims 1-3 (cancelled).

Claim 4 (currently amended). A soft decision method for demodulating a received signal $\alpha + \beta i$ of a square Quadrature Amplitude Modulation (QAM) consisting of an in-phase signal component and a quadrature phase signal component, comprising:

receiving the signal $\alpha + \beta i$ in a radio communication apparatus;

obtaining a plurality of conditional probability vector values, each being a soft decision value corresponding to a bit position of a hard decision, using a function including a conditional determination operation from the quadrature phase component and the in-phase component of the received signal,

wherein a conditional probability vector decision method for demodulating a first half of a total number of bits is the same as a decision method for demodulating the remaining half of the bits, and is determined by substituting a quadrature phase component value and an in-phase component value with each other, and

wherein the demodulation method of the conditional probability vector corresponding to an odd-ordered bit is the same as a calculation method of the conditional probability vector corresponding to the next even-ordered bit, where the received signal value used to calculate the conditional probability vector corresponding to the odd-ordered bit uses one of the α and β according to a given combination constellation diagram and the received signal value for the even-ordered bit uses the remaining one of α and β .

Claim 5 (currently amended). A soft decision method for demodulating a received signal $\alpha + \beta i$ of a square Quadrature Amplitude Modulation (QAM) consisting of an in-phase signal component and a quadrature phase signal component, comprising:

receiving the signal $\alpha + \beta i$ in a radio communication apparatus;

obtaining a plurality of conditional probability vector values, each being a soft decision value corresponding to a bit position of a hard decision, using a function including

a conditional determination operation from the quadrature phase component and the in-phase component of the received signal,

wherein a first conditional probability vector decision method for demodulating a first half of a total number of bits is the same as a second conditional probability vector decision method for demodulating a second half of the bits, and is determined by substituting a quadrature phase component value and an in-phase component value with each other,

wherein the demodulate signal has 2n bits,

wherein the conditional probability vector values corresponding to the first bit to n^{th} bit of the first half are demodulated by one of the received signal components α and β, and the conditional probability vector values corresponding to the $(n+1)^{th}$ to $2n^{th}$ bits of the second half are demodulated by the remaining one of the received signal components α and β, and an equation applied for the two demodulations is the same in the first half and the second half, and

wherein a first conditional probability vector is determined by selecting one of the received signal components α and β according to a combination constellation diagram and applying the following mathematical expression, where

① an output value is unconditionally determined as $\frac{a}{2^n}\Omega$, where Ω is a selected and received value which is one of α and β, and [[α]] $\underline{a}$ is an arbitrary real number set according to a desired output scope.

Claim 6 (currently amended). A soft decision method for demodulating a received signal $\alpha + \beta i$ of a square Quadrature Amplitude Modulation (QAM) consisting of an in-phase signal component and a quadrature phase signal component, comprising:

receiving the signal $\alpha + \beta i$ in a radio communication apparatus;

obtaining a plurality of conditional probability vector values, each being a soft decision value corresponding to a bit position of a hard decision, using a function including a conditional determination operation from the quadrature phase component and the in-phase component of the received signal,

wherein a conditional probability vector decision method for demodulating a first

half of a total number of bits is the same as a decision method for demodulating the remaining half of the bits, and is determined by substituting a quadrature phase component value and an in-phase component value with each other,

wherein the demodulate signal has 2n bits,

wherein the conditional probability vector values corresponding to the first bit to n^{th} bit of the first half are demodulated by one of the received signal components α and β, and the conditional probability vector values corresponding to the $(n+1)^{th}$ to $2n^{th}$ bits of the second half are demodulated by the remaining one of the signal components α and β, and an equation applied for the two demodulations is the same in the first half and the second half, and

wherein a second conditional probability vector is determined by the received value selected when determining a first conditional probability vector and by employing the following mathematical expression,

where an output value is unconditionally determined as $\frac{a(c-\frac{c}{2^{n-1}}|\Omega|)}{2}$, where Ω is a selected and received value, n is a magnitude of the QAM, that is, a parameter used to determine 2^{2n}, a is an arbitrary real number set according to a desired output scope, and c is an arbitrary constant.

Claim 7 (currently amended). A soft decision method for demodulating a received signal $\alpha + \beta i$ of a square Quadrature Amplitude Modulation (QAM) consisting of an in-phase signal component and a quadrature phase signal component, comprising:

receiving the signal $\alpha + \beta i$ in a radio communication apparatus;

obtaining a plurality of conditional probability vector values, each being a soft decision value corresponding to a bit position of a hard decision, using a function including a conditional determination operation from the quadrature phase component and the in-phase component of the received signal,

wherein a conditional probability vector decision method for demodulating a first half of a total number of bits is the same as a decision method for demodulating the remaining half of the bits, and is determined by substituting a quadrature phase component value and an in-phase component value with each other,

wherein the demodulate signal has 2n bits,

wherein the conditional probability vector values corresponding to the first bit to n^{th} bit of the first half are demodulated by one of the received signal components α and β, and the conditional probability vector values corresponding to the $(n+1)^{th}$ to $2n^{th}$ bits of the second half are demodulated by the remaining one of the signal components α and β, and an equation applied for the two demodulations is the same in the first half and the second half, and

wherein third to n^{th} conditional probability vectors are determined by a received value set when determining a first conditional probability vector and employing the following mathematical expression (A),

where in the mathematical expression (A),

first, dividing an output diagram in a shape of a basic V form, wherein conditional probability vector corresponding to each bit is divided into $(2^{k-3}+1)$ areas,

determining a basic expression according to $a(\frac{d}{2^{n-k+1}}|\Omega|-d)$

determining an output finding an involved area using a given Ω and substituting a value of (|Ω|-m) such that a middle value is subtracted from each area into the basic expression as a new Ω, and

rendering the middle value as $m=2^n$ and substituting the value of (|Ω|-m) into the basic expression as a new Ω in an area that is in the most outer left and right sides among the divided areas, that is, $(2^{k-2}-1)2^{n-k+2} <|\Omega|$, where Ω is a selected and received value, n is a magnitude of the QAM, that is, a parameter used to determine 2^{2n}, k is conditional probability vector number (k = 3, 4, …, n), d is a constant that changes according to the value of k, and a is a constant determining an output scope.

Claim 8 (previously presented). The method according to claim 7, wherein the $(n+1)^{th}$ to $2n^{th}$ conditional probability vectors are sequentially obtained using one of the received values of α and β that is not selected when the first conditional probability vector is determined and the mathematical expressions described above, except that the number k of the conditional probability vector included in the mathematical expression (A) sequentially substitutes 3 to n with n+1 to 2n).

Claim 9 (previously presented). The method according to claim 4, wherein a first conditional probability vector is determined by selecting any one of the received signal

components α and β according to a form of a combination constellation diagram and then according to the following mathematical expression:

an output value is unconditionally determined as $-\frac{a}{2^n}\Omega$, where Ω is a selected and received value that is one of α and β, n is a magnitude of the QAM, that is, a parameter used to determine 2^{2n}, and a is an arbitrary real number set according to a desired output scope.

Claim 10 (previously presented). The method according to claim 9, wherein a second conditional probability vector is determined by substituting the received value selected with the received value that is not selected in the method for obtaining the first conditional probability vector.

Claim 11 (previously presented). The method according to claim 4, wherein a third conditional probability vector is determined by selecting one of the received values α and β according to a form of a combination constellation diagram, using the following mathematical expression (B) in the case of $\alpha\beta \geq 0$, and substituting a received value selected in the mathematical expression (B) with a received value that is not selected in the expression in the case of $\alpha\beta < 0$, where in the mathematical expression (B) an output value is determined as $a(c-\frac{c}{2^{n-1}}|\Omega|)$, where Ω is a selected and received value, n is a magnitude of the QAM, that is, a parameter used to determine 2^{2n}, a is an arbitrary real number set according to a desired output scope, and c is an arbitrary constant.

Claim 12 (previously presented). The method according to claim 11, wherein a fourth conditional probability vector is calculated by substituting each of the received values used with each of the received values that are not used in the method for obtaining the third conditional probability vector in the cases of $\alpha\beta \geq 0$ and $\alpha\beta < 0$.

Claim 13 (previously presented). The method according to claim 4, wherein a fifth conditional probability vector is determined by selecting one of the received values α and β according to the form of the combination constellation diagram, using the following mathematical expression (C) in the case of $\alpha\beta \geq 0$, and determines by substituting the received

value selected in the mathematical expression (C) with the received value that is not selected in the expression in the case of $\alpha\beta<0$, where in the mathematical expression (C),

① first, dividing an output diagram in a shape of a basic V form, and the conditional probability vector corresponding to each bit is divided into 2 areas,

② a basic expression according to a basic form is determined as $a(\frac{d}{2^{n-2}}|\Omega|-d)$,

③ an output is determined by finding an involved area using a given Ω and substituting a value of ($|\Omega|$-m) that a middle value is subtracted from each area into the basic expression as a new Ω,

④ rendering the middle value as $m=2^n$ and substituting the value of $|\Omega|-m$ into the basic expression as a new Ω in an area that is in the most outer left and right sides among the divided areas, that is, $7\cdot 2^{n-3}<|\Omega|$, where $\Omega$is a selected and received value, n is a magnitude of the QAM, that is, a parameter used to determine 2^{2n}, d is a constant, and a is a constant determining the output scope.

Claim 14 (previously presented). The method according to claim 13, wherein when the magnitude of QAM is 64-QAM, a sixth conditional probability vector is calculated by substituting each of received values used with each of the received values that are not used in the method for obtaining the fifth conditional probability vector in the cases of $\alpha\beta\geq 0$ and $\alpha\beta<0$.

Claim 15 (previously presented). The method according to claim 4, wherein when the magnitude of QAM is more than 256-QAM, fifth to $(n+2)^{th}$ conditional probability vectors are determined by selecting one of the received values α and β according to the form of the combination constellation diagram, using the following mathematical expression (D) in the case of $\alpha\beta\geq 0$, and substituting the received value selected in the mathematical expression (D) with the received value that is not selected in the case of $\alpha\beta<0$, where in the mathematical expression (D),

① first, dividing an output diagram in a shape of a basic V form, and the conditional probability vector corresponding to each bit is divided into $(2^{k-5}+1)$ areas,

② a basic expression according to the basic form is determined as $a(\frac{d}{2^{n-k+3}}|\Omega|-d)$,

③ an output is determined by finding an involved area using a given Ω and substituting a value of |Ω|-m that a middle value m (for example, in the case of k=6, since repeated area is 1, this area is $2^{n-2} \leq|\Omega|<3\cdot2^{n-2}$ and the middle value is $m=2^{n-1}$) is subtracted from each area into the basic expression as a new Ω,

④ rendering the middle value as $m=2^n$ and substituting the value of |Ω|-m into the basic expression as a new Ω in an area that is in the most outer left and right sides among the divided areas, that is, $(2^{k-2}-1)2^{n-k+2}<|\Omega|$, where k is the conditional probability vector number (5, 6,…n), Ω is a selected and received value, n is a magnitude of the QAM, that is, a parameter used to determine 2^{2n}, a is a constant determining the output scope, and d is a constant that changes according to a value of k.

Claim 16 (currently amended). The method according to claim 15, wherein when the magnitude of QAM is more than 256-QAM, the $(n+3)^{th}$ to $(2n)^{th}$ conditional probability vectors are selected by the mathematical expression [[28]] <u>(D)</u> using the received value that is not selected when determining the fifth to $(n+2)^{th}$ conditional probability vector in the case of αβ≥0,

and is obtained by substituting the received value selected in the mathematical expression (D) with the received value that is not selected in the expression in the case of αβ<0.

Claim 17 (currently amended). The method according to claim 4, wherein a first conditional probability vector is determined by selecting any one of the received values α and β according to a form of the combination constellation diagram and then according to the following mathematical expression (E), where in the mathematical expression (E),

① if $|\Omega|\geq2^n-1$, an output is determined as a*sign(Ω),

also, ② <u>if</u> |Ω|≤1, the output is determined as a*0.9375*sign(Ω),

also, ③ <u>if</u> $1<|\Omega|\leq2^n-1$, the output is determined as $a*sign(\Omega)[\frac{0.0625}{2^n-2}(|\Omega|-1)+0.9375]$,

where Ω is any one of the received values α and β, 'sign(Ω)'indicates the sign of the

selected and received value, 'a' is an arbitrary real number set according to a desired output scope, α is a received value of I (real number) channel, and β is a received value of Q (imaginary number) channel.

Claim 18 (previously presented). The method according to claim 4, wherein a second conditional probability vector is determined by a received value selected when determining a first conditional probability vector and the following mathematical expression (F), where in the mathematical expression (F)

① if $2^n-2^{n(2-m)} \leq|\Omega|\leq 2^n-2^{n(2-m)}+1$, an output is determined as $a*(-1)^{m+1}$,

② if $2^{n-1}-1 \leq|\Omega|\leq 2^{n-1}+1$, the output is determined as $a*0.9375(2^{n-1}-|\Omega|)$,

③ if $2^{n-1}-2^{(n-1)(2-m)}+m \leq|\Omega|\leq 2^n-2^{(n-1)(2-m)}+m-2$,

the output is determined as $-a*[\frac{0.0625}{2^n-2}(|\Omega|-2m+1)+0.9735(-1)^{m+1}+0.0625]$,

where Ω is a selected and received value, n is the magnitude of QAM, that is, a parameter used to determine 2^{2n}, 'a' is an arbitrary real number set according to a desired output scope, and m=1,2.

Claim 19 (previously presented). The method according to claim 18, wherein third to $(n-1)^{th}$ conditional probability vectors of the first form are determined by the received value selected when determining the first conditional probability vector and the mathematical expression (G), where in the mathematical expression (G),

① if $m*2^{n-k+2}-1 <|\Omega|\leq m*2^{n-k+2}+1$, the output is determined as $a*(-1)^{m+1}$,

also, ② if $(2\ell-1)*2^{n-k+1}-1<|\Omega|\leq(2\ell-1)*2^{n-k+1}+1$,

the output is determined as $a*(-1)^{\ell+1}0.9375\{(|\Omega|-(2\ell-1)*2^{n-k+1})$,

also, ③ if $(P-1)*2^{n-k+1}+1 <|\Omega|\leq P*2^{(n-k+1}-1$,

when P is an odd number, the output is determined as

$$a*[\frac{0.0625}{2^{n-k+1}-2}[(-1)^{(p+1)/2+1}*|\Omega|+(-1)^{(p+1)/2}[(P-1)*2^{n-k+1}+1]+(-1)^{(p+1)/2}]],$$

when P is an even number, the output is determined as

$$a*[\frac{0.0625}{2^{n-K+1}-2}[(-1)^{p/2+1}*|\Omega|+(-1)^{p/2}(P*2^{n-k+1}-1)]+(-1)^{p/2+1}],$$

where m in mathematical expression (G) is 0, 1, ...2^{k-2}, and ℓ is 1, 2,...3^{k-2}, k is conditional probability vector number (k=3, ...n-1).

Claim 20 (previously presented). The method according to claim 19, wherein the n^{th} conditional probability vector is determined by the received value selected when determining the first conditional probability vector and the following mathematical expression (H), where in the mathematical expression (H),

① if $m*2^2-1 \leq |\Omega| \leq m*2^{n2}+1$, the output is determined as $a*(-1)^{m+1}$,

also, ② if $(2\ell-1)*2^1-1<|\Omega|\leq(2\ell-1)*2^1+1$,

the output is determined as $a*(-1)^{\ell+1}0.9375\{(|\Omega|-(2\ell-1)*2^1)$,

where m in mathematical expression (H) is 0, 1,...2^{n-2} and ℓ is 1, 2,...3^{n-2}.

Claim 21 (previously presented). The method according to claim 20, wherein the $(n+1)^{th}$ to $2n^{th}$ conditional probability vectors are sequentially obtained using the received value that is not selected when determining the first conditional probability vector and the mathematical expressions (F) to (H), respectively, except that the conditional probability vector number k included in the mathematical expression (G) is sequentially used as 3 to n-1 instead of n+3 to 2n-1.

Claim 22 (currently amended). The method according to claim 4, wherein a first conditional probability vector is determined by selecting any one of the received values α and β according to a form of the combination constellation diagram and then according to the mathematical expression (I), where in the mathematical expression (I),

① if $|\Omega|\geq 2^n-1$, the output is determined as $-a*\text{sign}(\Omega)$,

also, ② <u>if</u> $|\Omega|\leq 1$, the output is determined as $a*0.9375*\text{sign}(\Omega)$,

also, ③ <u>if</u> $1<|\Omega|\leq 2^n-1$, the output is determined as $-a*[sign(\Omega)\frac{0.0625}{2^n-2}(|\Omega|-1)+0/9275]$,

where 'sign(Ω)'indicates the sign of the selected and received value.

Claim 23 (previously presented). The method according to claim 4, wherein a second conditional probability vector is calculated by substituting a received value selected in

a method for obtaining a first conditional probability vector with a received value that is not selected in the method.

Claim 24 (previously presented). The method according to claim 4, wherein a third conditional probability vector is determined by selecting any one of the received values α and β according to a combination constellation diagram, using the following mathematical expression (J) in the case of $\alpha*\beta\geq0$, and substituting the selected and received value in the mathematical expression (J) with the received value that is not selected in the mathematical expression (J) in the case of $\alpha*\beta<0$, where in the mathematical expression (J),

① if $2^n-2^{n(2-m)}\leq|\Omega|\leq2^n-2^{n(2-m)}+1$, the output is determined as $a*(-1)^m$,

also, ② if $2^{n-1}-1\leq|\Omega|\leq2^{n-1}+1$, the output is determined as $a*0.9375(|\Omega|-2^{n-1})$,

also, ③ if $2^{n-1}-2^{(n-1)(2-m)}+m\leq|\Omega|\leq2^n-2^{(n-1)(2-m)}+m-2$,

the output is determined as $a*[\frac{0.0625}{2^n-2}(|\Omega|-2m+1)+0.9735(-1)^m-0.0625]$,

where Ω is a selected and received value, 'a' is an arbitrary real number set according to a desired output scope, α is a received value of I (real number) channel, β is a received value of Q (imaginary number), and m=1,2.

Claim 25 (previously presented). The method according to claim 4, wherein when the magnitude of QAM is less than 64-QAM, a fourth conditional probability vector is calculated by substituting each of received values used with each of the received values that are not used in the method for obtaining a third conditional probability vector in the cases of $\alpha*\beta\geq0$ and $\alpha*\beta<0$.

Claim 26 (previously presented). The method according to claim 4, wherein when the magnitude of QAM is 64-QAM, a fifth conditional probability vector is determined by selecting one of the received values α and β according to the form of a combination constellation diagram, and using the following mathematical expression (K) in the case of $\alpha*\beta\geq0$, and substituting the received value selected in the mathematical expression (K) with the received value that is not selected in the expression in the case of $\alpha*\beta<0$, where in the mathematical expression (K),

① if $m*2^{n-1}-1 \leq|\Omega|\leq m*2^{n-1}+1$, the output is determined as $a*(-1)^{m+1}$,

also, ② if $(2\ell-1)*2^{n-1}-1<|\Omega|\leq(2\ell-1)*2^{n-1}+1$,

the output is determined as $a*(-1)^{\ell+1}\{0.9375|\beta|-0.9375(2\ell-1)*2^{n-1}\}$,

where Ω is a selected and received value, 'a' is an arbitrary real number set according to a desired output scope, α is a received value of I (real number) channel, β is a received value of Q (imaginary number) channel, m=0, 1,2, and ℓ=1, 2.

Claim 27 (previously presented). The method according to claim 4, wherein when the magnitude of QAM is 64-QAM, a sixth conditional probability vector is calculated by substituting each of received values used with each of the received values that are not used in a method for obtaining a fifth conditional probability vector of the second form in the cases of $\alpha*\beta\geq0$ and $\alpha*\beta<0$.

Claim 28 (previously presented). The method according to claim 4, wherein when the magnitude of QAM is more than 256-QAM, fourth to n^{th} conditional probability vectors are determined by selecting one of the received values α and β according to the form of a combination constellation diagram, using the following mathematical expression (L) in the case of $\alpha*\beta\geq0$, and substituting the received value selected in the mathematical expression (L) with the received value that is not selected in the expression in the case of $\alpha*\beta<0$, where in the mathematical expression (L),

ⓐ if $m*2^{n-k+3}-1<|\Omega|\leq m*2^{n-k+3}+1$, the output is determined as $a*(-1)^{m+1}$,

also, ⓑ if $(2\ell-1)*2^{n-k+2}-1<|\Omega|\leq(2\ell-1)*2^{n-k+2}+1$,

the output is determined as $a*(-1)^{\ell+1}\{0.9375(|\Omega|-0.9375(2\ell-1)*2^{n-k+2})$,

also, ⓒ if $(P-1)*2^{n-k+2}+1<|\Omega|\leq P*2^{n-k+2}-1$,

when P is an odd number, the output is determined as

$$a*[\frac{0.0625}{2^{n-K+2}-2}[(-1)^{(p+1)/2+1}*|\Omega|+(-1)^{(p+1)/2}[(P-1)*2^{n-k+2}+1]]+(-1)^{(p+1)/2}],$$

when P is an even number, the output is determined as

$$a*[\frac{0.0625}{2^{n-k+1}-2}[(-1)^{p/2+1}*|\Omega|+(-1)^{p/2}(P*2^{n-k+2}-1)]+(-1)^{p/2+1}],$$

where k is conditional probability vector numbers (4, 5,..., n), Ω is a selected and

received value, 'a' is an arbitrary real number set according to a desired output scope, α is a received value of I (real number) channel, β is a received value of Q (imaginary number) channel, m= 0, 1, ..2^{k-3}, ℓ is 1, 2,...3^{k-3}, and p=1, 2..., 2^{k-2}.

Claim 29 (previously presented). The method according to claim 4, wherein when the magnitude of QAM is more than 256-QAM, $(n+1)^{th}$ conditional probability vectors are determined using the following mathematical expression (M) in the case of $\alpha*\beta\geq0$, and substituting the received value selected in the mathematical expression (M) with the received value that is not selected in the expression in the case of $\alpha*\beta<0$, where in the mathematical expression (M),

ⓐ if $m*2^2-1 \leq|\Omega|\leq m*2^2+1$, the output is determined as $a*(-1)^{m+1}$,

also, ⓑ if $(2\ell-1)*2^1-1<|\Omega|\leq(2\ell-1)*2^1+1$,

the output is determined as $a*(-1)^{\ell+1}\{0.9375\{(|\Omega|-0.9375(2\ell-1)*2^1)$,

where Ω is a selected and received value, 'a' is an arbitrary real number set according to a desired output scope, α is a received value of I (real number) channel, β is a received value of Q (imaginary number) channel, m= 0, 1, ..2^{k-2}, and ℓ is 1, 2,...3^{k-2}.

Claim 30 (previously presented). The method according to claim 28, wherein when the magnitude of QAM is more than 256-QAM, a method for obtaining an $(n+2)^{th}$ conditional probability vector is the same as the method for obtaining the fourth conditional probability vector in the case that the magnitude of QAM of the second form is less than 256-QAM.

Claim 31 (previously presented). The method according to claim 28, wherein when the magnitude of QAM is more than 256-QAM, $(n+3)^{th}$ to $(2n-1)^{th}$ conditional probability vectors are calculated by substituting each of received values used with each of the received values that are not used when determining the fourth to n^{th} conditional probability vectors in the cases of $\alpha*\beta\geq0$ and $\alpha*\beta<0$ when the magnitude of QAM of the second form is more than 256-QAM.

Claim 32 (previously presented). The method according to claim 28, wherein when the magnitude of QAM is more than 256-QAM, a $2n^{th}$ conditional probability vector is

calculated by substituting each of the received values used with each of the received values that are not used when determining the fourth to the $(n+1)^{th}$ conditional probability vectors in the cases of $\alpha*\beta\geq0$ and $\alpha*\beta<0$ when the magnitude of QAM of the second form is more than 256-QAM.

Claims 33-38 (cancelled).